

TO WHOM IT MAY CONCERN:

Be it known that we, DITMAR L. GORGES, a citizen of Germany, and MICHAEL HIGGINS, a citizen of the United States of America, both residents of the City and County of Los Angeles, State of California, have invented certain new and useful improvements in

HORIZONTAL-FLOW TRAP AND HOUSING ASSEMBLY  
WITH ODOR PREVENTING CLOSURE MECHANISM

of which the following is a specification.

HORIZONTAL-FLOW TRAP AND HOUSING ASSEMBLY WITH ODOR  
PREVENTING CLOSURE MECHANISM

CROSS-REFERENCE TO RELATED APPLICATION

5           This application claims the benefit, and is a continuation of application Serial  
No. 10/055,833 filed 22 January 2002, in turn a continuation-in-part of U.S. Provisional  
Application No. 60/263,321 filed 22 January 2001, which is a continuation-in-part of  
application Serial No. 09/515,870 filed 29 February 2000.

10           REFERENCE REGARDING FEDERAL SPONSORSHIP  
Not Applicable

REFERENCE TO MICROFICHE APPENDIX

Not Applicable

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1. Field of the Invention

          The present invention relates to a horizontal-flow trap and housing assembly  
and, in particular, to such an assembly with an odor preventing closure mechanism  
and improvements in the engagements and disengagements, and sealing, between  
20   the odor trap cartridge and the housing.

2. Description of Related Art and Other Considerations

          So-called "waterless urinals" such as described in United States Patent  
6,053,297, have been devised to conserve water. Thus, there is interest in toilets and  
25   urinals designed to minimize the amount of water consumed in flushing, to mitigate

excessive demands on both water supplies and wastewater disposal systems, both of which have tended to become overloaded with increasing populations.

The solution advanced in constructions such as described in United States Patent 6,053,297 utilizes a cartridge or container accommodated in a housing. The housing has an exit tube which is connected to a sewer line. The cartridge includes an oil-sealed odor trap. The wastewater enters the cartridge through an opening in its top wall and exits through an opening in its bottom wall. When the cartridge is properly held in its housing, the cartridge exit opening is aligned with the housing exit tube and the flow of wastewater proceeds smoothly. However, if the two exits are misaligned, such flow is interrupted and becomes turbulent and the turbulence created in the wastewater may adversely affect proper operation of the cartridge.

A need has also arisen to provide a closure for the housing exit tube when the cartridge is not in place, such as to replace a spent cartridge with a new one. Such a closure prevents sewer gasses from escaping into a habitable room.

With respect to removal and replacement of cartridges, the tool used therefor must provide a secure and firm grip with the cartridges, and be easy to manipulate.

Furthermore, it is desirable that the cartridge be firmly sealed within the housing, and be easily insertable into and removable therefrom. While existing constructions have operated satisfactorily, improvements are also desired to assure insertion and removal.

It has also been discovered that not all exit tubes from the housing are dimensioned to fit all sizes of external drain fittings.

## SUMMARY OF THE INVENTION

These and other problems are successfully addressed and overcome by the present invention. The housing and the cartridge are provided with a mutually

engageable implementations which accurately define positions of initial unsecured and final secured interconnections between the two. These implementations ensure that the housing exit tube and the cartridge exit opening are at least aligned at the position of final secured interconnection. Such implementations preferably utilize a key and keyway interconnection system which not only defines the secured and unsecured positions but also ensures the proper orientation of the cartridge with respect to the housing, thereby to avoid any possible misalignment between the housing exit tube and the cartridge exit opening. The key and keyway interconnection system also includes contrivances for firmly retaining the cartridge within the housing (e.g., a ratchet-type engagement) and for facilitating disassembly of the cartridge from the housing (e.g., by a ramp).

Blockage at the housing exit tube is facilitated by a closure mechanism which is associated with the housing and which is coupled to the cartridge so that, when the cartridge is moved from its secured to its unsecured position, the closure mechanism moves to seal off the exit tube.

Relative movements between the cartridge and the housing are facilitated by a tool which engages the wastewater openings in the cartridge and which enables turning of the cartridge with respect to the housing. Specifically, a latching mechanism between the tool and the cartridge provides a secure and firm grip therebetween, especially when the cartridge is to be removed from the housing.

Several advantages are derived from this arrangement. Alignment between the cartridge exit opening and the housing exit tube is assured. The exit tube is closed when the cartridge is not fully seated in the housing, to prevent unpleasant sewer gasses from entering the housing. Removal and insertion of the cartridge from and into the housing is facilitated.

Other aims and advantages, as well as a more complete understanding of the present invention, will appear from the following explanation of exemplary embodiments and the accompanying drawings thereof.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts a perspective view of the present invention including an odor trap insert or cartridge positioned within a housing, having an exit tube coupled to a sewer disposal. The housing may comprise a portion of a urinal or entry in a floor. Fittings on the exit tube are shown in phantom for adapting the housing to different  
10 pipes.

FIGS. 2 and 2A illustrate an interior portion of the housing shown in FIG. 1, and are particularly directed to an odor-blocking swivelable lever and cap to portray the respective covering and uncovering of the entrance to the exit tube in the housing. Specifically, the covering occurs when the odor trap cartridge is not fully operationally  
15 engaged within the housing, and the uncovering proceeds when the odor trap cartridge is moved to be fully operationally engaged within the housing. While the swivelable lever may be removed, is desired, its use is preferred.

FIG. 3 is an exploded view of the present invention showing the arrangement of the odor trap cartridge with respect to the housing, the positioning of the odor trap cartridge with respect to its coupling with and maneuvering of the odor-blocking swivelable lever and cap, and a plug member tool which is engageable with the odor  
20 trap cartridge for insertion and removal of the cartridge into and from the housing.

FIGS. 4 and 5 depict alternate arrangements of the exit tube extending from the housing.

25 FIG. 6 and 6A illustrate the means by which the present invention may be secured to a urinal structure.

FIG. 7 is a cross-sectional view of the housing depicted in FIG. 2.

FIGS. 8A - 8D illustrate, in seriatim, the steps of engagement and the implementation utilized therein of the odor trap cartridge with the housing, encompassing the uncovering of the entrance to the exit tube by odor-blocking swivelable lever and cap. The implementation includes keys on the cartridge and  
5 keyways in the housing for locking these two components together when assembled and for encouraging unlocking when disassembled.

FIG. 9 is a view of the top wall of the cartridge taken from its outside surface.

FIG. 10 is a view of the top wall of the cartridge taken from its inside surface.

10 FIG. 11 is a cross-sectional view of the top wall of the cartridge taken along line 11 - 11 of FIG. 8A.

FIG. 12 is an exploded view of the engagement of portions of the odor trap cartridge and the housing and a sealing O-ring. FIG. 12A is a cross-sectional view of the O-ring prior to being its being inserted within a groove in the cartridge.

15 FIGS. 13 - 15 illustrate employment of the plug member tool and its engagement with the odor trap cartridge for enabling insertion and removal of the cartridge into and from the housing.

FIG. 16 is a bottom view of the odor trap cartridge and its keys.

20 FIGS. 16A, 16B and 16C are views of the keys depicted in FIG. 16, taken respectively along lines 16A - 16A, 16B - 16B and 16C - 16C thereof.

FIG. 17 is a top view of the housing.

FIGS. 17A, 17B and 17C are views of the keyways depicted in FIG. 17, taken respectively along lines 17A - 17A, 17B - 17B and 17C - 17C thereof.

Accordingly, a horizontal-flow trap and housing assembly 20 with odor preventing closure mechanism comprises an odor trap cartridge 22 which is disposed to be inserted within and removed from a housing 24. Cartridge 22 may take any convenient form, such as those which are disclosed in United States patent No. 6,053,197. Urine enters the cartridge through entry opening 26, and exits from the housing through an exit tube 28. The exit tube is coupled to drains leading to a waste disposal repository, as required by sanitation laws and regulations. To enable assembly 20 to be coupled to any size of drain that exists throughout the world, exit tube 28 and housing 24 are configured to receive a plurality of differently sized fittings 30, shown in phantom, whose dimensions conform to those of all countries.

As best shown in FIG. 7 (but see also FIGS. 1 - 3) housing 24 includes a body 32 to which a flange 34 is secured by any suitable means, such as by a molding process. Body 32 is provided with external threads 36 onto which a nut 38 is threaded. Flange 34 includes a lip 40 which is adapted to rest upon a support so that the combination of flange 34 and nut 38 will permit housing 24 and, therefore, assembly 20 to be secured firmly in place to a support, such as a floor or a part of a urinal. Nut 38 includes a plurality of fin-like extensions 42 which may be gripped by a user's fingers to thread the nut onto body 32. Lip 40 is sloped towards odor trap cartridge 22 to direct urine into the cartridge.

Housing body 32 comprises a tubular wall 44, onto which threads 36 are formed, and a bottom wall 46. In one embodiment as depicted in FIGS. 1, 3, 6 - 8 and 17, exit tube 28 extends from the tubular wall, extending from an opening 48 therein. In other embodiments as shown in FIGS. 4 and 5, housings 24a and 24b are provided respectively with exit tubes 28a and 28b extending from their bottom walls 46a and 46b, rather than from their tubular walls 44a and 44b. In all embodiments, bottom walls 46, 46a and 46b are sloped towards exit tubes 28, 28a and 28b to encourage

drainage of urine into their respective exit tubes. In at least one of the embodiments, as best depicted in FIGS. 2A, 3, 7 and 8A - 8D, an increasingly deepening U-shaped depression 50 is formed in bottom wall 46 to aid in the liquid flow and, more importantly, to accommodate an important odor-blocking feature of the present invention.

This odor-blocking feature is effected by use of a lever 52 having a cap 54 and a projection 56 at opposed ends thereof. Lever 52 is mounted on a pivot 58 extending from bottom 46 of housing body 32, and is swivelable about the pivot to cover or uncover opening 48 leading to exit tube 28. When cap 54 is positioned to cover opening 48, any unpleasant odors from the sewer gasses are blocked from entering housing 24 and beyond. Such covering and uncovering is dependent upon the operative positioning of odor trap cartridge 22 in the housing, which positioning will be explained hereinafter in conjunction with the description of the cartridge. As shown in FIG. 7, pivot 58 is provided with a slot 58a which forms a pair of mount halves 58b and 58c having a bifurcated T-shaped flange 58d. This pivot effects mounting of lever 52 onto bottom 46. Mount halves 58b and 58c are adapted to slightly flex towards one another to permit lever 52 to be snapped over bifurcated flange 58d and, thus, to secure the lever on bottom 46, which is the preferred assembly. However, to accommodate parties not desiring use of the lever, lever 52 may be removed simply by snapping it from its mounting engagement on pivot 58 as enabled by the flexibility of mount halves 58b and 58c.

Housing body 32 is further provided with three L-shaped keyways 60a, 60b and 60c, as best illustrated in FIGS. 17 and 17A - 17C, which are generally shown as a keyway 60 in FIGS. 2, 2A, 7 and 8A - 8D and two keyways 60a and 60b in FIG. 3. The keyways are formed in the interior surface of tubular wall 44 but they do not extend fully through the wall. Keyways 60a, 60b and 60c are spaced unequally from



one another within tubular wall 44, that is, at disparate angles from one another which are not spaced 120° from one another. Each keyway includes a vertical component 62' or 62" and a generally horizontal component 64' or 64" in FIGS. 17A - 17C (in FIGS. 2, 2A, 3, 7 and 8A - 8D the generally horizontal component is commonly identified by indicium 64).

The difference between vertical components 62' and 62" is that the former has a lesser depth than that of the latter. The difference between generally horizontal components 64' or 64" is that component 64' has a lesser vertical height than component 64".

Each generally horizontal component 64' and 64" is provided with an upper corrugated surface 66 and a lower smooth surface 68. Both surfaces 66 and 68 are generally parallel to one another, and both slope slightly downwardly as they extend further away from their vertical components 62. As previously stated above, the import of the differently configured keyways 60a, 60b and 60c are dependent upon the operative positioning of odor trap cartridge 22 in the housing, which positioning will be explained hereinafter in conjunction with the description of the cartridge.

Cartridge 22 (see FIGS. 3, 8A - 8D and 12) has a cylindrical configuration defined by a tubular wall 70 terminated by a bottom wall 72 and a top wall 74. The top wall is sloped downwardly to a flat, generally horizontal flat center portion 76 in which entry opening 26 is disposed, and extends from lip 40 of housing flange 34 (see FIG. 3) to direct the flow of liquid into the cartridge. As further depicted in FIGS. 9 - 15, opening 26 comprises a tripartite arrangement of three arced slots 26a, 26b and 26c, as best shown in FIG. 3. As illustrated in FIG. 16, bottom wall 72 includes an exit or lower opening 78, as distinguished from entry or upper opening 26 (FIGS. 8A - 8D), for discharge of fluids from cartridge into exit tube 28. When the cartridge is properly

inserted into the housing, exit opening 78 will be aligned with opening 48 in housing 24 to its exit tube 28.

Details of opening 26 and its three slots 26a, 26b and 26c, and generally horizontal flat center portion 76 of top wall 74 are illustrated in FIGS. 9 - 11. Flat center portion 76 of the top wall is depicted as having opposed upper and under surfaces 76a and 77. As shown in FIGS. 9 and 11, upper surface 76a of center portion 76 is sloped or curved towards the entries to openings 26a, 26b and 26c, or the openings are beveled to encourage flow of liquid into the openings and to prevent retention of any liquid due to surface tension effects. As shown in FIG. 10, undersurface 77 is provided with downwardly extending protuberances 77a adjacent one side of each opening 26a, 26b and 26c. The purposes of protuberances 77a will be fully explained shortly with respect to FIGS. 13-15.

A small off-center blind hole 80 also extends into bottom wall 72 but not through the bottom wall, and is adapted to engage projection 56 on lever 52.

Cartridge 22 is further provided with three keys of which one is designated with indicium 82' and two are designated with the same indicium 82", as best illustrated in FIGS. 16 and 16A - 16C, which are generally shown as a keyway 82 in FIGS. 3 and 8A - 8D. Like keyways 60a, 60b and 60c, all three keys 82' and 82" are spaced unequally from one another within cartridge 22, that is, at disparate angles from one another which are not spaced 120° from one another. Their angular orientation, however, exactly matches those regarding keyways 60a, 60b and 60c. As best shown in FIGS. 16A - 16C, key 82' has a vertical dimension which is less than those of both keys 82". Furthermore, key 82' is mated to engage keyway 60a while keys 82" are respectively mated to engage respective keyways 60b and 60c. The heights of the keys are so coordinated with the heights of their respective keyways in that their respective contacts result in an interference fit therebetween. To encourage a facile

engagement, the keys are rounded at their top surfaces 84 and bottom surfaces 86. Thus, top surfaces 84 and bottom surfaces 86 of the keys are disposed to respectively contact corrugated and smooth surfaces 66 and 68 of the keyways. Furthermore, the figures illustrating the keys and keyways are paired to form pairings of FIG. 16A with  
5 FIG. 17A, FIG. 16B with FIG. 17B, and FIG. 16C with FIG. 17C.

To provide a proper sealing between cartridge 22 and housing 24, as shown in FIGS. 8A - 8D and 12, an O-ring 88 is positioned within an annular groove 90 in cartridge 22, adjacent its top wall 74. The sealing engagement provided by O-ring 88 is enhanced, as more clearly shown in FIG. 12, by configuring the O-ring with two pairs  
10 of upwardly and downwardly extending annular ridges 88a and 88b and an outwardly extending annular projection 88c. Ridges 88a and 88b furnish larger areas of engagement with annular groove 90.

Insertion and withdrawal of the cartridge in and from the housing is facilitated by use of a tool 92, shown in FIGS. 3 and 13 - 15. The tool includes a shank 94, a  
15 handle 96 at one end, and three arced T-shaped projections 98 which extend from a surface 100 (see FIGS. 13 - 15) at its opposed end. The T-shaped projections are provided with appendages 102' and 102" of unequal length, with appendage 102' being shorter than appendage 102". FIG. 13 depicts insertion of T-shaped projection into an opening 26. FIG. 14 illustrates use of tool 92 to remove the cartridge from the  
20 housing, and FIG. 15 illustrates use of tool 92 to insert the cartridge into the housing. The distinctions between use of the tool for cartridge insertion and removal lies in the cooperative engagement of appendages 102' and 102" in openings 26. Specifically, when the cartridge is to be removed from the housing, it is desired that there be a greater surface engagement between the tool appendage and the undersurface  
25 (designated by indicium 77) of flat center portion 76; this extended surface engagement is provided by larger appendage 102". For insertion purposes, however,

appendage 102' is needed only for a minimum locking between the tool and the cartridge, inasmuch as the insertion force is defined by contact between tool surface 100 and cartridge flat center portion 76.

To assure a firm engagement of tool appendages 102", in particular, with flat center portion 76 of cartridge top wall 74, an interlock is formed between appendages 102" and undersurface 77 of center portion 76. This interlock is provided by downwardly extending protuberances 77a on undersurface 77 and upwardly extending protuberances 104 on appendages 102". When appendages 102" are moved to their positions as depicted in FIG. 14, a locking engagement is effected between tool 92 and cartridge 22 to resist unintentional disengagement of these parts.

In operation and with reference to FIGS. 8A - 8D, when it is desired to insert cartridge 22 into housing 24, projections 98 of tool 92 are inserted into openings 26 of the cartridge, as described above. The cartridge is inserted into the housing, and turned until key 82' and keys 82" are aligned with their respective keyways 60a - 60c. This alignment also provides a proper registration between the two different depths of keyways with respect to the two different heights of the keys. The result is a dual alignment system that ensures that the cartridge will properly fit into and be aligned with the housing. This alignment further ensures that exit opening 78 of cartridge 22 will be aligned with opening 48 in housing 24 and its exit tube 28.

When the keys are properly ordered with their mating keyways as shown in FIG. 8A, cartridge 22 will be positioned with respect to housing 24, and will permit the cartridge to be pushed into the housing as illustrated in FIG. 8B. At this point, off-center hole 80 in cartridge bottom wall 72 will be aligned with projection 56 of lever 52, and keys 82 will rest on smooth surface 68 at the entrance of horizontal keyway components 64. The cartridge will then be in position to be turned by tool 92, as depicted in FIGS. 8C and 8D. This turning causes lever 52 to swivel, through the

engagement between hole 80 and projection 56, and to move cap 54 away from covering opening 48. During this turning operation, the top surfaces 84 of the keys will ratchet against their respective corrugated surfaces 66 and lock the cartridge within the housing. Simultaneously, O-ring 88 will be deformed into a sealing engagement  
5 between these two parts.

When it is desired to remove the cartridge from the housing, tool 92 and its appendages 102" are engaged within openings 26. A turning of the tool will move keys 82 along inclined smooth surfaces and provide a camming process so as to facilitate separation of the cartridge from the housing. The resiliency of O-ring 88 will  
10 also provide a separation force.

Although the invention has been described with respect to particular embodiments thereof, it should be realized that various changes and modifications may be made therein without departing from the spirit and scope of the invention.